

In The Claims

Please amend claim 16, as follows. The entire set of pending claims, including the clean version of the amended claim, is provided in the APPENDIX attached hereafter.

16. (Twice Amended) The liquid crystal display of 15, further comprising[:] a supplementary gate wire which is located either on or under the gate wire and made of either molybdenum nitride or molybdenum alloy nitride.

REMARKS

In response to the Office Action dated November 14, 2002, claim 6 has been amended. Claims 4, 5, 14-17 and 21 are active in this application, of which claims 4 and 14 are independent.

Entry of the Amendments and Remarks is respectfully requested because entry of Amendment places the present application in condition for allowance, or in the alternative, better form for appeal. No new matters are believed to be added by this Amendments. Based on the above Amendments and the following Remarks, Applicants respectfully request that the Examiner reconsider the outstanding objections and rejections and they be withdrawn.

Rejections Under 35 U.S.C. §103

In the Office Action, claims 4 and 5 have been rejected under 35 U.S.C. §103(a) for being unpatentable over Japanese Patent Publication No. 08-254680 issued to Kubo, *et al.* (“Kubo”) in view of U. S. Patent No. 6,219,125 issued to Ishikura, *et al.* (“Ishikura”). This rejection is respectfully traversed.

As mentioned in the background portion of the present application, “when an ITO layer is etched by using *an etchant, hydrochloric acid and nitric acid* are used. However, it may happen that the etchant *penetrates* the passivation layer, contacts the data wire and the gate pad, and then *erode the data wire and the gate pad*. Accordingly, the data wire and the gate pad may be disconnected and/or eroded” (Specification, Page 2, Lines 13-17).

To solve this problem, the present invention teaches, as shown in Figs. 2 and 3, forming a supplementary data layer 550 made of either molybdenum nitride or molybdenum alloy nitride under the data wire 500 (Fig. 1), 510 and 520 (Fig. 2). Also, “the supplementary data wire 550 maybe located on the data line 500” (Specification, page 6, line 1).

Later on the process, “an ITO layer is deposited and patterned to form a pixel electrode 700 connected to the drain electrode 520 through the contact hole C1 and a gate ITO layer 710 connected to the gate pad 230 through the contact hole 720 as shown in Fig. 4F. Here the etchant for the ITO layer comprises hydrochloric acid and nitride acid, which may *penetrate along the crack of the passivation layer 600 or along the edges of the ITO wire 700 and 710, and then may reach the data wire 500, 510 and 520, and the gate pad 230*” (Specification, page 8, lines 16-22).

However, “because the supplementary gate wire 250 and the supplementary data wire 550 have a low chemical reaction against the ITO etchant, the gate wire 200, 210 and 230, and the data wire 500, 510 and 520 through the supplementary gate wire 250 and the supplementary data wire 550 are *not disconnected*” (Specification, page 8, line 24 to page 9, line 4).

In the Office Action, the Examiner admitted that “JP 8-254680 does not expressly disclose the supplementary layer located either on or under the entire wire and made of either Mo-nitride or Mo-alloy nitride” (Office Action, Page 2).

Regarding this missing feature, the Examiner asserted “the reference Ishikura discloses ... that in each metal electrode (3) ..., the adhesive layer (11) ... preferably comprise a metal Mo or alloy or the metal nitride (so that the adhesive layer (11) would be Mo-nitride or Mo-alloy nitride, and located under the wire (3), and the metal electrode (3) also comprises a material of Mo or Mo-allay); and a protective layer(13) (it also is a wire) preferably comprise a metal Mo or alloy or the metal nitride (so that the protection layer (13) would be Mo-nitride or Mo-alloy nitride, and located on the wire (3), and the metal electrode (3) also comprises a material of Mo or Mo-alloy) ...” (Office Action, page 6).

Based upon these two pieces of prior art, the Examiner asserted “it would have been obvious to those skilled in the art at the time of the invention was made to arrange the wire layer made of Mo or Mo-alloy and a supplementary layer on or under the wire layer using Mo nitride or Mo-alloy nitride as in claim 4 for improving the corrosion resistance, improving the adhesiveness and enhancing the electrical conduction with electrodes” (Office Action, Page 3). This assertion is respectfully disagreed with.

The primary reference to Kubo teaches a gate electrode (e.g., scanning line) Yn-1 that is consisting of a pure aluminum layer 111, a molybdenum layer 113 formed on the layer 111, and a Mo-tungsten alloy layer 115 covering the layers 113 and 115. As the Examiner admits, Kubo “does *not* expressly teach the supplementary layer located either on or under the entire wire layer and made of either Mo-nitride or Mo-alloy nitride” (Office Action, page 2).

Also, the molybdenum layer 113 is a part of the gate electrode Yn-1 that is covered and protected by a gate insulation layer 121 and thus not venerable to the etchant for patterning a pixel electrode 181. The present invention is directed to providing a supplementary layer to a gate pad and a data line that approximates to the ITO pixel electrode and hence venerable to the

etchant for patterning the ITO pixel electrode. Thus, modifying the gate electrode Yn-1 is not what the present invention is directed to.

The secondary reference to Ishikura is directed to forming a Mo nitride layer on or under a copper or copper nitride principal electroconductive layer 12 so as to work as an adhesive layer 11 (Fig. 2) and/or a protection layer 13 (Fig. 3), respectively. The Mo nitride adhesive layer 11 further increases an adhesiveness between the glass substrate 2 and the metal electrode 3, and the Mo nitride protection layer 13 increases a surface roughness of the metal electrode 3.

If the gate line Yn-1 of Kubo is modified such that the adhesive layer 11 or the protection layer 13 of Ishikura is formed on or under the molybdenum layer 113, it would not be possible to sufficiently decrease the wiring resistance of the gate line Yn-1. Thus, the asserted combination would render the intended purpose of Kubo unsatisfactory.

Also, the asserted combination would be directed to the modification of the gate line Yn-1 in Kubo. As previously mentioned, the present invention is directed to preventing the etchant for the ITO layer comprises hydrochloric acid and nitride acid from penetrating along the crack of the passivation layer 600 or along the edges of the ITO wire 700 and 710, and then may reach the data wire 500, 510 and 520, and the gate pad 230. The gate electrode 210 does not require such protection because it is covered and protected by the gate insulating film 300.

In Kubo, the gate electrode Yn-1 is covered and protected by the gate insulating layer 121, and hence gate electrode Yn-1 does not require an additional layer for protection from the etchant. Rather, as aforementioned, such modification would deteriorate the wiring resistance, thereby rendering the intended purpose of Kubo unsatisfactory. Thus, there is no motivation for combining Kubo and Ishikura.

Further, in Kubo, the data lines (e.g., source and drain regions of the thin film transistor) is provided with no supplementary layer protect from being eroded by an etchant. Thus, even if the structure of Kubo is modified such that the Mo-nitride layer of Ishikura 11 or 13 is formed on or under the molybdenum layer 113 of Kubo, as asserted by the Examiner, it would not be possible to protect the source and drain electrodes of the TFT from being eroded by an etchant.

Also, in Kubo, it appears that the pixel electrode 181 is formed prior to forming the source and drain electrodes because the drain electrode is formed over a portion of the pixel electrode 181. Since the pixel electrode is etched prior to forming the data line, Kubo would not be directed to protecting the data line from being eroded by the etchant. Thus, it is submitted that there is no motivation for combining the teachings of the Kubo and Ishikura.

For these reasons, it would not have been obvious to combine the teachings of the applied reference to arrive at the claimed invention. Thus, claim 4 would be patentable over Kubo and Ishikura. Claim 5 that is dependent from claim 4 would be also patentable at least for the same reason. Accordingly, Applicants respectfully request that the rejection over claims 4 and 5 be withdrawn.

In the Office Action, claims 14-17 and 21 have been rejected under 35 U.S.C. §103(a) for being unpatentable over Applicants' Admitted Prior Art ("AAPA") in view of Kubo and further in view of Ishikawa. This rejection is respectfully traversed.

As the Examiner admitted, AAPA "does not expressly disclose the data wire is made of either molybdenum or molybdenum alloy, and a supplementary data wire is located either on or under the entire data wire and made of either molybdenum nitride or molybdenum alloy nitride".

As previously mentioned, these missing features are neither taught or suggested by Kubo and Ishikawa. Thus, it would not have been obvious to combine the teachings of the applied reference to arrive at the claimed invention.

Therefore, it is submitted that independent claim 14 is patentable over AAPA, Kubo and Ishikawa. Claims 15-17 and 21 that are dependent from claim 14 would be also patentable at least for the same reason. Accordingly, Applicants respectfully request that the rejection over claims 14-17 and 21 be withdrawn.

Other Matters

In this response, claim 16 has been amended for clarification purposes only.

CONCLUSION

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete response has been made to the outstanding Office Action and, as such, claims 4, 5, 14-17 and 21 are in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Myung-Koo HUR, et al.
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Prompt and favorable consideration of this Amendment is respectfully requested.

Respectfully submitted,



Hae-Chan Park
Reg. No. 50,114

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McGuire Woods LLP
1750 Tysons Boulevard
Suite 1800
McLean, VA 22102-4215
Tel: 703-712-5000
Fax: 703-712-5050
HCP:WSC/kbs